PROJECT facts

U.S. Department of Energy
National Energy Technology Laboratory
& Office of Industrial Technologies

Strategic Center for Natural Gas

10/2000

Developing Power Systems for the 21st Century — Fuel Cell/ATS Hybrid Systems

PRIMARY PROJECT PARTNERS

Siemens Westinghouse Power Corporation/Allison Engine Company
Pittsburgh, PA

Siemens Westinghouse Power Corporation/Caterpillar Inc.
Pittsburgh, PA

M-C Power Corporation/Allison Engine Company
Chicago, IL

Fuel Cell Energy/Allison Engine Company
Danbury, CT

McDermott Technologies/ Northern Research and Engineering Corporation
Alliance, OH

MAIN SITES

Alliance, OH
Chicago, IL
Danbury, CT
Pittsburgh, PA

COST SHARING

DOE-FE	$500,000
DOE-EE	$300,000
Non-DOE	$200,000

STRATEGIC CENTER FOR NATURAL GAS WEBSITE

www.netl.doe.gov/scng

Project Description

The National Energy Technology Laboratory (NETL) issued a Program Research and Development Announcement (PRDA) for conceptual feasibility studies of high-efficiency fossil power plants (HEFPPs) in early 1997. Five awards have been made under the PRDA to fuel cell manufacturers and turbine suppliers to explore the feasibility of linking power technologies in a way that would generate electricity from natural gas at unprecedented efficiencies.

Industry participants have singled out the fuel cell as the likely core of a successful hybrid power plant, and this project specifies that one of the components of the proposed hybrid plants must be a fuel cell. A fuel cell generates electricity efficiently by using an electrochemical reaction rather than combustion. If engineers can overcome technical obstacles in linking certain types of power equipment, it may be possible to produce a high-efficiency hybrid power plant configuration that would be commercially ready by the year 2010 or sooner. In the long term, FC/T hybrid systems have scaleup potential for coal-based Vision 21 applications.

The hybrid fuel cell/turbine (FC/T) power plant configures the high-temperature, conventional molten carbonate fuel cell (MCFC) or solid oxide fuel cell (SOFC) with a low-pressure-ratio gas turbine, air compressor, combustor, and in some cases, a metallic heat exchanger. The goal is a 21st century power plant that sharply reduces greenhouse gas emissions while generating electricity at unprecedented efficiencies. Electric conversion efficiencies of from 70 to more than 80 percent (LHV) are forecast for the FC/T system, and even higher efficiencies may be possible. The initial FC/T systems will be less than 20 megawatts (MW) in size, suitable for distributed power generation. The hybrid systems will be capable of producing electricity at costs of 10 to 20 percent below today's conventional plants, as well as reducing emissions of carbon dioxide, sulfur dioxide, and nitrogen oxides.

Project Duration

Start Date	May 1998
Projected End Date	August 1999

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CONTACT POINTS

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PROJECT PARTNERS

DOE Office of Fossil Energy
National Energy Technology Laboratory

DOE Office of Energy Efficiency and Renewable Energy
Office of Industrial Technology

CUSTOMER SERVICE

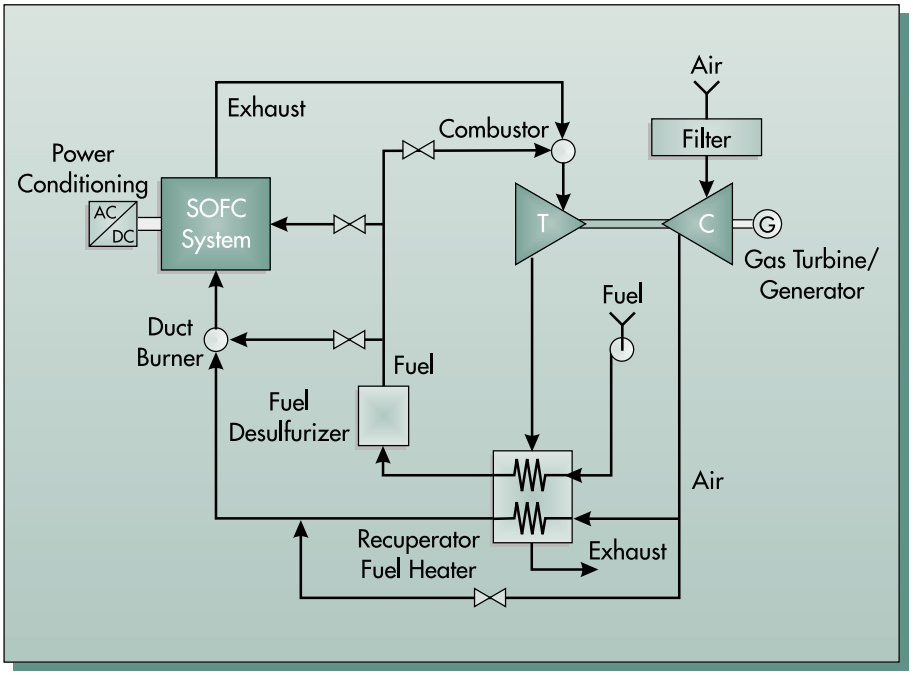
(800) 553-7681

Project Goal

The demonstration of successful hybrid plants will provide an option for meeting the growing needs of electricity, domestically and internationally, and with less environmental impact than current technology. Some studies indicate that integrating the fuel cell and turbine may be the quickest way to lower product cost and capture market share.

Project Benefits

Hybrid systems have the potential for extremely high efficiency in converting fossil fuel to AC electricity. The hybrid system offers a solution to the low efficiency and relatively high NO_x emissions of small gas turbines, and the high costs of small fuel-cell power plants. The combination of the fuel cell and turbine results in the fuel cell serving as the combustor for the gas turbine, and the gas turbine serving as the balance-of-plant for the fuel cell. The system offers a combined efficiency of greater than 70 percent and virtually no NO_x emissions.



Schematic of a Conceptual Hybrid System This system was proposed by Siemens Westinghouse and consists of several pressurized SOFC modules integrated with the small high-performance gas turbine being developed by Solar Turbines.